UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
WQ-16J

JUL 18 2012

Diana Klemens, Chief
Surface Water Assessment Section
Water Resources Division
Michigan Department of Environmental Quality
P.O. Box 30273
Lansing, Michigan 48909

Dear Ms. Klemens:

The U.S. Environmental Protection Agency has conducted a review of the document entitled, "Development of Site-Specific Aquatic Life Values for Total Copper for Water Bodies in the Upper Peninsula of Michigan," dated June 15, 2012. Enclosed are our comments on the approach described in the document. We look forward to working with your staff to address these comments.

Please feel free to contact me at (312) 886-6758 or Candice Bauer of my staff at (312) 353-2106.

Sincerely,

Linda Holst

Linda Holst
Chief, Water Quality Branch

Enclosure

cc: Tamara Lipsey, MDEQ

Review of document entitled "Development of Site-Specific Aquatic Life Values for Total Copper for Water Bodies in the Upper Peninsula of Michigan," dated June 15, 2012.

Summary of Proposed MDEQ SSC Approach

MDEQ has proposed to use the documented relationship between dissolved organic carbon (DOC) concentration in Upper Peninsula waters and measured water effect ratios (WER) as determined using *Ceriodaphnia dubia* acute toxicity testing to derive site-specific criteria (SSC) for copper for specific waters in the Upper Peninsula. Specifically, MDEQ utilizes measured DOC concentrations at a site to predict the species mean acute value (SMAV) WER that is applied to the approved chronic water quality criterion for copper resulting in a new chronic SSC for copper, called the FCV in Michigan's water quality standards. The 2007 WER study that serves as the basis for these SSC determinations was conducted at 18 sites in 17 waterbodies and showed that DOC is highly correlated to the WER determined at a site based upon measured copper toxicity to *C. dubia* in 48 hour static tests using site water and laboratory waters. Using the correlation between DOC and SMAV WER normalized for differences in hardness (Figure 9; MDEQ 2007, R2=0.5455), the SMAV WER is estimated (SMAV WER = 0.6001(DOC)-0.6019) and then the site specific FCV is determined (SS FCV=e^(0.8545*ln(hardness)-1.702)*SMAV WER). Please note that the slope of the FCV is identified as 0.8454*ln(hardness). However, it appears that this misstated the current slope of the adopted water quality criteria for copper and should be double-checked for accuracy in the June 15, 2012 draft document.

Difference between estimated and measured WERs

Upon conducting an initial analysis of the 2007 dataset, it was determined that the **estimated** SMAV WER (column AB) using the DOC regression equation above (as copied from Table 5; MDEQ 2007) resulted in several cases where the calculated site-specific FCV (column AD) appears to be less protective than the FCV calculated (column AE) using the SMAV WER derived from the **measured** WER (column AC), with differences in the resulting criteria up to a factor of 3-4 (less protective criteria when comparing MDEQ's proposed approach in AD to the criteria calculated using the actual WER derived from the study in AE are highlighted in column AE). Initial analysis of this same dataset using EPA's BLM criteria calculations (humic acid default of 10% used for calculations) showed that about 2 of 3 FCV calculations using MDEQ's SSC approach appear to be more protective than the CCCs (column AF) determined using the BLM (BLM derived CCCs that are more protective than the criteria derived using MDEQ's approach are highlighted in column AF). Thus, it appears that this initial analysis suggests that MDEQ's approach may not always result in SSC that are as protective as suggested to be necessary using the measured toxicity values to calculate the SMAV WER.

This initial analysis was completed using data from the 2007 study only (making it a hypothetical scenario of assessing the protectiveness of the MDEQ approach) since data on the sites for which MDEQ is actually deriving criteria does not include a measured WER or data necessary to run the BLM model. Only TOC, DOC, hardness, and copper concentrations are available for sites where SSC are being adopted (except that a SSC is being developed for that one river represented in the 2007 study). EPA is conducting further analysis of estimated BLM-based values using: (1) data estimates for water quality parameters not regularly sampled from Sturgeon and Trap Rock Rivers available in the 2007 study and (2) measured DOC and hardness

data used for SSC derivation (MDEQ 2012). We will share the results in the next few days. This will allow for further comparison of MDEQ and EPA's BLM approaches.

It appears that strategies to account for variation in the regression equation used to predict the WER, such as use of a more conservative equation, may be appropriate although EPA's consultation with experts in copper criteria, WERs, and site-specific criteria derivations are still ongoing with regards to this issue.

Choice of DOC estimate

Four DOC measurements from 2011 are available to estimate SSC. MDEQ chose the lowest of the four DOC measurements (rounded to the nearest whole number) at a site to calculate the SSC. However, EPA's initial analysis suggests more conservative approaches are possible due to three issues. First, rounding up to the nearest whole number results in a larger WER and resulting SSC than if the actual DOC value (reported to one decimal place) is used. Second, TOC values available for other years appear to suggest that DOC values used may not represent the true minimum in DOC values at a site. Third, calculation of confidence intervals around the mean using several DOC datasets from Appendix 2 appear to suggest that the minimum DOC used in calculation of SSC may be greater than the SSC calculated using the 95^{th} or 99^{th} percentile confidence interval around the mean. Further analysis of the effect of MDEQ's choice of DOC concentrations on protectiveness of SSC derivation appears to be appropriate.

DOC:TOC regression

In the SSC procedure with respect to determining the spatial extent of a site, MDEQ uses TOC to estimate DOC using the relationship denoted in Figure 3 (MDEQ 2012). Based upon EPA's initial analysis, it appears that this relationship over-predicts DOC at TOC concentrations less than about 8 and underestimates TOC at concentrations greater than about 10. Further, it appears that this relationship is not well supported with data at concentrations of TOC above 20. If the two data points with TOC greater than 20 are removed, it appears that the TOC to DOC relationship is nearly 1:1, meaning that in 2011 (a dry year) nearly all organic matter in the streams is dissolved and removing these two data points would be likely to greatly increase the R2 (currently R2=0.62). This nearly 1:1 relationship between TOC and DOC makes sense as it was a dry year and suspended solids were extremely low. In this way, it appears that the year of 2011 is a good year to determine minimum expected DOC concentrations.

For use in site determinations, initial analysis seems to indicate that the equation reported in Figure 3 should not be used for TOC less than about 10mg/L since DOC should never be greater than TOC (TOC is the sum of DOC and particulate organic carbon in water). A better approach may be to either recalculate the equation after removing the two data points where TOC is greater than 20 or to assume that DOC concentrations are equivalent to TOC concentrations. As such, EPA recommends that site determinations are reviewed in light of these issues to determine if differences in estimated DOC concentrations for a site would change the determination of the spatial extent to which the SSC should apply as it is not apparent whether or not the above issues will actually affect the determination of any sites.

Determination of Sites

Water quality information and landscape characteristics are used to determine the extent of a site for the purpose of applying SSC.

Upon review of Figure 4 (as well as other maps), it is not clear how the sites are defined. Specific questions/comments include: (1) are the yellow sites subject to SSC, (2) what are the colors on the streams, (3) can these segments be reference in text to match discussion in text to map, (4) some site ID numbers are hard to read, (5) it would be helpful to identify in the text why certain sites were left out (like Trap Rock River upstream from confluence with Scales Creek), and (6) some of the symbols are hard to read and appear to overlap. With regards to question 5, it appears it is meeting existing copper criteria and thus it is unlikely that copper coming from Trap Rock upstream is going to make meeting downstream criteria difficult (it is not contaminated), but inclusion of such discussion would be helpful in the text.

Accuracy of SSC

EPA is in the process of checking all calculations. EPA will double-check each identification of minimum DOC concentration (EPA has not yet cross-checked all values from those in Appendix 2), calculation of the DOC-SMAV WER equation (completed based upon current reported DOC in tables), and FCV/SSC calculation (completed based upon current reported DOC in tables). In addition, EPA continues to review in further detail the determination made as to the spatial extent of each site. EPA will contact MDEQ within one week if we find any errors. Please note that the lowest DOC appears to be misreported for Slaughterhouse Creek Calumet Lake site (12 vs 9.7) resulting in difference of 15ug/L (47vs 62ug/L) in the SSC according to my analysis of data. This should be double-checked and corrected, as necessary, in the June 15, 2012 document.

SSC review

As with all EPA-approved water quality standards, MDEQ should review the appropriateness of adopted SSC through future triennial reviews.